August 20, 1985

The Honorable Susumu Ono
Chairman and Member
Board of Land and Natural Resources
State of Hawaii
Kalanimoku Building, Room 130
1151 Punchbowl Street
Honolulu, HI 96813

Dear Chairman Ono:

Conservation District Use Application
to Permit Geothermal Development Activities
on State Lands, Puna District,
Island of Hawaii dated August 20, 1985

On behalf of the Trustees of the Estate of James Campbell, I am forwarding for your action the original and eighteen (18) copies of a Conservation District Use Application, enclosure (1), to permit geothermal development activities on State lands proposed for exchange with Campbell Estate's Kahauale'a lands within a to-be-designated geothermal resource sub-zone. The State lands under consideration include: TMK 1-2-10, Parcels 1, 2, & 3, an area of 27,673 acres more or less.

The Campbell Estate is in the process of completing its Supplemental Environmental Impact Statement for the proposed project and expects to file the Statement on or about September 20, 1985.

In this revised application for a land-use permit, the applicant is requesting authority to discover and develop geothermal resources to a level that will allow, as an upper limit for the first increment of development, a specific amount of electricity to be generated as the market or demand for that electricity is established.

Since the proposed action is now a "permitted use" in geothermal resource sub-zones, the applicant is preparing and will submit, upon receipt of the land-use permit, applications for operational permits as required and as development activities proceed in accordance with DLNR Rules, sub-title 7, Water & Land Development, on the leasing and drilling of geothermal resources,

Chapter 183. As a guide to the major operations permit requirements under this chapter, as understood by the applicant, enclosure (2) identifies and summarizes the permit applications and information requirements to be submitted to the Board and DLNR prior to initiating operations within the designated GRS and during project operations.

Should you have any questions regarding the application, please do not hesitate to call me.

Very truly yours,

O. K. Stender
Chief Executive Officer

OKS:ba

Enclosures: 1) Master Application Form with Supplemental Sheets
2) Summary of Operating Permits for Geothermal Development

February 1983

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

FOR DLNR USE ONLY
Reviewed by _____
Date _____
Accepted by _____
Date _____
Docket/File No. _____
180-Day Exp. _____
EIS Required _____
PH Required _____
Board Approved _____
Disapproved _____
Well No. _____

DEPARTMENT MASTER APPLICATION FORM

(SEE ATTACHED SUPPLEMENTAL SHEETS)

(Print or Type)

I. LANDOWNER/WATER SOURCE OWNER (If State land, to be filled in by Government Agency in control of property)

Name Department of Land
Address and Natural Resources
P.O. Box 621
Honolulu, HI 96809
Telephone No. 548-6550
SIGNATURE _____
Date _____

II. APPLICANT (Water Use, omit if applicant is landowner)

Name Estate of James Campbell
Address 828 Fort Street Mall
Suite 500
Honolulu, Hawaii 96813
Telephone No. 536-1961
Interest in Property See note 1
(Indicate interest in property; submit written evidence of this interest)
*SIGNATURE _____
Date _____

*If for a Corporation, Partnership, Agency or Organization, must be signed by an authorized officer.

III. TYPE OF PERMIT(S) APPLYING FOR

( ) A. State Lands
See note 2 (X) B. Conservation District Use
( ) C. Withdraw Water From A Ground Water Control Area
( ) D. Supply Water From A Ground Water Control Area
( ) E. Well Drilling/Modification

IV. WELL OR LAND PARCEL LOCATION REQUESTED

District Puna
Island Hawaii
County Hawaii
Tax Map Key See note 3
Area of Parcel See note 3
(Indicate in acres or sq. ft.)
Term (if lease) N/A

V. Environmental Requirements (See note 4)

Pursuant to Chapter 343, Hawaii Revised Statutes, and in accordance with Section 1:308 of the EIS Regulations for applicant actions, an Environmental Assessment of the proposed use must be attached. The Environmental Assessment shall include, but not be limited to the following:

A. Identification of application;

B. Description of proposed use and statement of objectives;

C. Description of affected environment, including appropriate maps and plans to show location, topography, site improvements, existing utilities and vegetation and archaeological/historical sites, if any. (See page 5, section I).

D. General description of the technical, economic, social and environmental characteristics of the proposed use.

NOTE: The Environmental Assessment may be substituted in lieu of the information required above.

INFORMATION REQUIRED FOR ALL USES

I. Description of Parcel (See note 5)

A. Existing structures/Use. (Attach description or map).

B. Existing utilities. (If available, indicate size and location on map. Include electricity, water, telephone, drainage, and sewarage).

C. Existing access. (Provide map showing roadways, trails, if any. Give street name. Indicate width, type of paving and ownership).

D. Vegetation. (Describe or provide map showing location and types of vegetation. Indicate if rare native plants are present).

E. Topography; if ocean area, give depths. (Submit contour maps for ocean areas and areas where slopes are 40% or more. Contour maps will also be required for uses involving tall structures, gravity flow and other special cases).

F. If shoreline area, describe shoreline. (Indicate if shoreline is sandy, muddy, rocky, etc. Indicate cliffs, reefs, or other features such as access to shoreline).

G. Existing covenants, easements, restrictions. (If State lands, indicate present encumberances).

H. Historic sites affected. (If applicable, attach map and descriptions).

See note 6 II. Description: Describe the activity proposed, its purpose and all operations to be conducted. (Use additional sheets as necessary).

III. Commencement Date: Upon receipt of all required permits (Estimate April 1986)

Completion Date: Sixty five years from date of geothermal mining lease

IV. TYPE OF USE REQUESTED (Mark where appropriate)

XX 1. Permitted Use (exception occasional use); (Geothermal resource sub-DLNR Title 13, Chapter 2, Section _____; Subzone _____. zone to be designated by BLNR)

2. Accessory Use (accessory to a permitted use): DLNR Title 13, Chapter 2, Section _____; Subzone _____.

3. Occasional Use: Subzone _____.

4. Temporary Variance: Subzone _____.

5. Conditional Use: Subzone _____.

Area of Proposed Use Approximately 11,000 acres (proposed geothermal resource sub-zone)
(Indicate in acres or sq. ft.)

Name & Distance of Nearest Town or Landmark
POHOA - approximately 6 miles; KALAPANA - approximately 4 miles.

Boundary Interpretation (If the area is within 40 feet of the boundary of the Conservation District, include map showing interpretation of the boundary by the State Land Use Commission).

Conservation District Subzone Geothermal resource sub-zone
County General Plan Designation _____

V. FILING FEE

XX 1. Enclose $50.00. All fees shall be in the form of cash, certified or cashier's check, and payable to the State of Hawaii.

XX 2. If use is commercial, as defined, submit additional public hearing fee of $50.00.

INFORMATION REQUIRED FOR CONDITIONAL USE ONLY

I. Plans: (All plans should include north arrow and graphic scale).

A. Area Plan: Area plan should include but not be limited to relationship of proposed uses to existing and future uses in abutting parcels; identification of major existing facilities; names and addresses of adjacent property owners.

B. Site Plan: Site plan (maps) should include, but not be limited to, dimensions and shape of lot; metes and bounds, including easements and their use; existing features, including vegetation, water area, roads, and utilities.

C. Construction Plan: Construction plans should include, but not be limited to, existing and proposed changes in contours; all buildings and structures with indicated use and critical dimensions (including floor plans); open space and recreation areas; landscaping, including buffers; roadways, including widths; offstreet parking area; existing and proposed drainage; proposed utilities and other improvements; revegetation plans; drainage plans including erosion sedimentation controls; and grading, trenching, filling, dredging or soil disposal.

D. Maintenance Plans: For all uses involving power transmission, fuel lines, drainage systems, unmanned communication facilities and roadways not maintained by a public agency, plans for maintenance shall be included.

E. Management Plans: For any appropriate use of animal, plant, or mineral resources, management plans are required.

F. Historic or Archaeological Site Plan: Where there exists historic or archaeological sites on the State or Federal Register, a plan must be submitted including a survey of the site(s); significant features; protection, salvage, or restoration plans.

II. Subzone Objective: Demonstrate that the intended use is consistent with the objective of the subject Conservation District Subzone (as stated in Title 13, Chapter 2).

SUPPLEMENTAL SHEETS TO MASTER APPLICATION FORM

INTRODUCTION

This CDUA represents a revision to a previously submitted CDUA for exploration and development of geothermal resources on Kahauale'a lands, Puna District, Island of Hawaii, which was acted on by the Board of Land and Natural Resources (BLNR) Decision and Order of February 25, 1983.

The Environmental Impact Statement (EIS) for the Kahauale'a Geothermal Project was approved by BLNR on July 30th, 1982. The EIS for Kahauale'a was submitted in support of the above described CDUA.

Subsequent to approval of the EIS for the Kahauale'a Geothermal project, the State legislature enacted two laws dealing with geothermal development; (Act 296, Session Laws of Hawaii, 1983 and Act 151, Session Laws of Hawaii, 1984). These acts provided that "geothermal development activities" could occur in any of the land use districts in the State within specified boundaries established by the Board of Land and Natural Resources (BLNR) as a Geothermal Resource Sub-zone (GRS) in accordance with criteria established in the Acts, but subject to application for and issuance of all required permits on a project-by-project basis. Act 296 defined Geothermal development activities as those activities associated with the

exploration and development of geothermal resources and the production of those resources to generate electrical energy. A portion of Kahauale'a was designated by BLNR as a geothermal resource sub-zone by BLNR Decision and Order of 28 December 1984.

In the foregoing Decision and Order, BLNR also proposed that the landowner of Kahauale'a (the Estate of James Campbell) consider a land exchange of Kahauale'a for adjoining State-owned land in the middle east rift zone of Kilauea (the Puna Forest Reserve, the Wao Kele O Puna Natural Area Reserve, and such other adjacent State land as would be appropriate). If such exchange is determined to be feasible and is consummated in conjunction with the designation of a suitable GRS within the exchanged State lands, geothermal development activities in this area of the Kilauea east rift zone would occur in the exchanged lands rather than Kahauale'a.

Upon the designation of a GRS within the lands to be exchanged and upon issuance of the proper permits for geothermal development in the State lands to be exchanged, the land exchange would be considered completed and the presently designated GRS for Kahauale'a and the Wao Kele O Puna Natural Area Reserve would be terminated. A Natural Area Reserve would then be designated in Kahauale'a.

The landowners (Campbell Estate and the State) have agreed in principal to the proposed land exchange consisting of

approximately 25,000 acres, more or less, from each land area. The Legislature, during the 1985 session, passed unanimously a joint resolution which indicated the Legislature was favorably disposed to the State's proposed land exchange. Steps have been initiated between the parties to undertake the actions required to appraise the separate values of the affected lands and consummate the land exchange. In addition, action has been initiated by the State to designate additional portions of the Kilauea east rift zone as a geothermal resource sub-zone, which will include a portion of the lands to be exchanged.

The "accepting authority" for the EIS for the Kahauale'a Geothermal Project (BLNR) has determined that as a result of relocating proposed geothermal development activities to the adjoining State lands, a Supplemental Environmental Impact Statement (SUP EIS) is required to describe and document the changes in the environmental setting of the proposed action and to determine whether there would be any changes in the environmental impacts predicted in the EIS for the proposed geothermal development activities, or in the mitigation measures described therein to reduce or prevent those impacts.

The Supplemental Environmental Impact Statement in support of this revised CDUA is being prepared on the assumption that the State's proposed land exchange will occur. All information in the EIS for Kahauale'a that is not directly affected by this planned relocation of the project site to adjoining State land

remains valid, is applicable to the SUP EIS, and is incorporated in the SUP EIS by reference by authority of the Board of Land and Natural Resources.

NOTES

(NOTE 1) - SECTION II, PAGE 1: APPLICANT'S INTEREST IN PROPERTY.

The applicant's interest in the property described in Section IV is based on the State's proposal to exchange this property for the applicant's Kahauale'a property for the purpose of conducting geothermal development activities on the State property to be exchanged in lieu of Kahauale'a. Upon appraisal and valuation of the two properties and agreement on the acreage to be exchanged, and upon execution of the exchange, the applicant will become the fee owner of the State property described herein, modified by any acreage adjustment that may be required as a result of the appraisal of the two properties. The State's proposal for a land exchange involving the State property of interest is contained in BLNR's Decision and Order G.S. No. 8/27/84-1 of 28 December 1984 as follows:

> ".... II. The State of Hawaii formally requests the Estate of James Campbell to investigate and consider a land exchange involving State owned land in Kilauea middle east rift zone and Campbell Estate's lands at Kahauale'a (excluding Tract 22)."

The proposed action is a joint enterprise of the Estate of James Campbell and the True/Mid-Pacific Geothermal Venture, an experienced energy exploration and development group from Casper, Wyoming.

(NOTE 2) - SECTION III., B., PAGE 1: TYPE OF PERMIT

This is a Conservation District Use Application (CDUA) for a permit to conduct geothermal development activities on State land (described in Section IV) which the Board of Land and Natural Resources in its Decision and Order of December 28, 1984 proposed to be exchanged for Campbell Estate's Kahauale'a lands, Puna District, Island of Hawaii. The proposed activities constitute a "permitted use" within a geothermal resource sub-zone.

The data provided in this CDUA represents a revision and addition to the previously submitted CDUA for geothermal development activities enclosed with Campbell Estate letter of March 2, 1982, acknowledged by BLNR letter of March 29, 1982 and acted on by the Board's Decision and Order of 25 February 1983. The application requests a land use permit to conduct geothermal development activities in accordance with Act 296, SLH, 1983 and Act 151, SLH, 1984, and DLNR Administrative Rules, Chapter 183, governing the leasing for and mining of geothermal resources.

Under the terms of the proposed land exchange as described in Campbell Estate letter of February 13, 1985, and BLNR's letter response thereto of May 23, 1985, it is recognized that final action on this application is subject to:

(1) BLNR's designation of a GRS in the State land proposed for exchange.

(2) BLNR's approval of the supplemental EIS to the EIS for Kahauale'a.

(3) Execution of the land exchange.

In the event the land exhange is not executed due to (1) BLNR's disapproval of this CDUA, (2) A legislative veto of the land exchange, or (3) the land exchange has not been completed by the adjournment of the 1986 legislative session, the applicant wil resume actions under the current CDU permit for Kahauale'a.

(NOTE 3) - SECTION IV, PAGE 1: LOCATION OF LAND PARCEL FOR PROPOSED ACTION.

Tax map keys of State lands being considered for exchange and in turn as a prospective site for geothermal development activities:

	TMK	Area of Parcel
(1)	TMK 1-2-10:3 (Conservation)	16,843 Acres
(2)	TMK 1-2-10:2 (Puna Forest Res., Conservation)	8,890 Acres
(3)	TMK 1-2-10:1 (Agricultural)	1,930 Acres
		27,663 Acres

(NOTE 4) - SECTION V, PAGE 2: ENVIRONMENTAL REQUIREMENTS.

A. Applicant: The Estate of James Campbell.

B. Description of Proposed Use & Statement of Objectives:

(1) Proposed Use--

a. To conduct as a permitted use, within the State land to be exchanged and the to-be-designated geothermal resource sub-zone (GRS), geothermal development activities, defined in Act 296, SLH, 1983 and Act 151, SLH 1984, as follows:

b. The scope of the initial geothermal development activities requested to be permitted within the GRS at this time is as follows:

To discover and produce sufficient geothermal energy and construct necessary facilities to generate and sustain for 30 years or more up to 100mw of electricity.

(See Note 6 for Section II, Page 3 of Master Application Form for description of development activities.)

(2) Statement of Objectives

a. General Objectives

The State of Hawaii is almost totally dependent on imports of crude oil and petroleum products

and is vulnerable to supply disruptions and price fluctuations in the global energy market. As a consequence of the high cost of imported fuel, electricity rates in Hawaii are among the highest in the nation.

Because of Hawaii's recent volcanic origin and geography, the State has no indigenous fossil fuel reserves and is isolated from systems such as coal and natural gas. Fortunately, Hawaii is rich in renewable energy resources which is becoming available under new and improved technologies. Those resources include geothermal, solar, wind, biomas, hydropower, and ocean thermal gradients.

Because of the abundance of renewable natural resources in Hawaii, the State's efforts are now directed toward decreasing the dependence upon imported fuel and focusing on the development of indigenous energy sources such as geothermal energy.

In 1978, the State Legislature eneacted the Hawaii State Plan, Chapter 226 of the Hawaii Revised Statutes. The purpose of the plan is to

improve the State-wide planning process, which is to articulate goals, objectives, and policies intended to guide future development in Hawaii. The State Plan defines two energy objectives. The first is to provide a dependable, efficient, and economical State-wide energy system capable of supporting the current and future needs of the people of Hawaii. The second is to provide increased energy self-sufficiency by decreasing Hawaii's dependence on imported fuel.

The amended General Plan of the County of Hawaii places emphasis upon energy self-sufficiency because of the excessive dependence on imported oil and the escalating cost of electricity. The County's objectives include energy self-sufficiency and the establishment of the Big Island as a demonstration community for the development and use of natural energy resources.

The overall objective of the proposed project is to explore for and develop the geothermal resources within the State lands to be exchanged, Puna District, Island of Hawaii, to produce electricity as a major contribution toward achieving the above energy objectives of the State and County Plans.

b. The specific objectives of the project are to:

(1) Discover, by deep exploration drilling, any existing geothermal reservoirs within the GRS;

(2) Evaluate any discovered reservoirs and geothermal resources through testing and analyses to determine whether such energy sources can be economically produced to generate electricity;

(3) Determine the general dimensions and extent of any discovered reservoirs by additional exploration and confirmation drilling;

(4) Develop tested and proven geothermal reservoirs (by drilling development wells) and construct, or cause to be constructed, necessary facilities to produce geothermal generated electricity to replace oil-generated electricity in increments that can be immediately absorbed by the utility company on Hawaii;

(5) In anticipation of the installation of a deep water electrical transmission cable to interconnect the islands and the predicted date on which such a cable would be activated, explore for and develop additional

geothermal reserves as required to supply the additional geothermal energy needed to replace a large increment of the oil-generated electricity on Oahu; and

(6) Explore for and develop such additional geothermal reserves as needed to sustain electrical generation at operating production levels and to provide for future growth in the demand for electricity throughout the State.

C. Description of Affected Environment.

1. Location of Proposed Action

The project location within the Puna District, Island of Hawaii, is indicated in Figure 1. The State lands being appraised for exchange with Campbell Estate lands include Conservation District lands, (the Puna Forest Reserve and the Wao Kele O Puna Natural Area Reserve) and agricultural land, as shown in Figure 2. The State land adjoins the eastern and southern boundary of the Kahauale'a ahupua'a which is adjacent to the Hawaii Volcanoes National Park. The east rift zone of Kilauea Volcano passes through both the State lands to be exchanged and Kahauale'a.

That portion of the State lands being considered for exchange in which permits for geothermal develop-

ment activities will be requested is the State proposed geothermal resource sub-zone (GRS) shown in Figure 3, an area of approximately 11,000 acres. Any changes to the proposed sub-zone would result in corresponding changes in the area in which geothermal development activities would occur. It has been estimated that the potential for discovering economically producible geothermal resources within the proposed GRS would be approximately equivalent to that for Kahauale'a because of its proximity to Kilauea Volcano and the volcanically active upper east rift zone of Kilauea.

2. Preliminary Description of the Affected Environment

The land area of the State lands being appraised for exchange is gradually sloping with elevations ranging from 2,200 feet down to 1,300 feet. The area within and surrounding the proposed geothermal resource sub-zone is rural, mostly forested with vegetation ranging from high quality native vegetation, with wet ohia forest with dense, 80% canopy to low quality vegetation and open areas devastated by lava flows in and below the rift zone. Exotic plant species are found generally in all areas except the highest quality, closed canopy native ohia forest.

There is evidence that portions of the ohia forest in the northeast sector of the State lands have been disturbed by human activity. The Adenophorus Periens, a rare fern, is known to exist in the northwest portion of the area. A portion of the Hawaii Volcanoes National Park southeastern boundary is approximately 2 miles from the western boundary of the State lands to be exchanged.

The Hawaiian Hawk ('Io) and Honeycreeper ('o'u) have been sighted in the area of the Kilauea middle east rift zone. There are no roads into the proposed geothermal resource sub-zone, and there are no known springs or wells in this area. Rainfall averages 120" per year.

A literature search for evidence of any significant archaeological sites within the State lands to be exchanged will be conducted. An archaeological survey will be made before clearing any site to be used in project operations.

D. General Description of the Technical, Economic, Social and Environmental Characteristics of the Proposed Use

1. Technical Characteristics

Geothermal energy is heat generated by natural processes within the earth. The most common type of

geothermal energy is in hydrothermal systems in which ground water has accumulated in a reservoir at depths of up to 2 miles below sea level and heated from the near presence of a magma intrusion from greater depths. These systems may be liquid (common) or vapor (rare) dominated and temperatures of the water or steam may vary from 90° C to over 300° C. The hot water and/or steam can be recovered from these resources by drilling 6,000-8,000 feet below sea level into the reservoir, expected to be a fractured pillow lava zone. In liquid dominated systems of sufficiently high temperatures, above 400° F, hot water is converted or flashed to steam as it flows up the well bore or as it reaches a separator under reduced pressure from which it is directed into a turbine-generator to generate electricity. Upon flowing to the surface, about 30% of the total produced fluids is expected to flash to steam.

Pressures of 2,200 to 2,800 psig are expected. The produced full well steam is anticipated to have a salinity of about 3,000 ppm and contain 500 - 1,000 ppm of Hydrogen Sulfide (H_2S). Abatement systems will be designed to control and limit H_2S emissions during extended well testing and for power plant operations.

Wells will be drilled with both air and drilling

mud using a conventional rotary rig with a rated capacity from 12,000 to 16,000 feet. All geothermal wells will be cased (and cemented) with standard steel pipe to protect the environment, ground water resources, and the geothermal resources. The planned well completions call for a string of 7" slotted liner to be installed across the productive intervals. The liner will be hung from a string of 9 5/8" casing set at 6,000 feet that is cemented back to the surface.

An initial production rate of 5 MW per well is anticipated. A 3% per year well decline rate has been estimated for planning purposes. Abandoned wells will be plugged with cement and closed.

Fluids produced from the wells will be piped to a power plant in steel pipes, 16-22 inches in diameter. Spent steam will be sent to surface condensers and then to a cooling tower. Gas ejectors will remove non-condensible gases from the condenser and send them to an incinerator to remove H_2S from the gas stream. Water from the separation system and plant condensate will be injected into the source aquifer after treatment. It is estimated that 1 injection well will be required for every 4 production wells.

It is expected that the turbine-generators will be single pressure admission condensing units. The

equipment will include all the necessary automatic tripping devices required to protect the unit when a malfunction occurs. The turbine blading will be stiff and short with stress levels considerably lower than those supplied for comparable fossil fuel steam turbines and will utilize those features which will result in long term reliable service with geothermal steam. Corrosion resistant materials will be specified for turbine internals in contact with geothermal steam.

The generator supplied with the turbine will be designed in accordance with the latest standards of ANSI C50.10-75, and C50.13-1975 and applicable NEMA and IEEE standards.

Makeup water will be provided from the steam condensate. Any additional water requirements (expected to be minimal) will be satisfied through purchase from County or private sources.

The condenser will be designed and constructed, where applicable, to conform with the latest ASME Code and will be of the "surface" type. The condenser will be constructed of clad carbon steel. Internal parts such as tubes and tube plates will be stainless steel. Water boxes will be carbon steel with epoxy coating. The liquid level in the condenser is controlled by

automatic liquid level controller. All the condensate from the geothermal steam is to be returned to the cooling water.

2. Economic Characteristics

It is estimated that each well with a depth of 8,000 feet will cost $1.7 to $2.5 million dollars which includes labor costs, site preparation, drilling pipe, cement, casing, drilling supplies and equipment operating costs. It is estimated that 8 wells will be required to supply a 25 MWe power plant at a cost of $13.6 to $20.0 million. A power plant using current design practices is expected to cost $1,200 to $1,600 per KW (1984 dollars) of generating capacity (e.g., a 25 MWe power plant could cost between $30.0 and $40.0 million). The gathering system (well head equipment, pipelines, separators) will cost approximately 20 percent of the cost of the consumer facility (power plant), or $6.0 to $8.0 million for a 25 MWe power plant. Field maintenance operations, including reworking of wells and drilling replacement wells, are expected to cost $2.7 million per year for a production system capable of supplying a 25 MWe power plant.

A royalty of 10% of gross sales of geothermal resources would be paid to the State except under cir-

cumstances where the Board of Land and Natural Resources determines that a reduction or waiver of the royalty for a limited period of time, not to exceed eight years, would be essential for development to be initiated or continued at a particular site.

3. Social Characteristics

The primary objective of the proposed action is to discover geothermal resources and to convert those resources into electricity to replace imported oil. The utility companies are almost totally dependent on imported oil for the generation of electricity. The State is therefore continually vulnerable to a disruption in supply of those resources or to sudden and dramatic price escalations due to policy decisions by oil producing countries or increasing world demand for a depletable resource.

Geothermal development involves well established technical and construction activities such as drilling and testing of wells, preparing sites, and constructing roads, power plants, pipe lines, and transmission lines, and the continuing operation and maintenance of those activities. Except for the initial drilling crew and some initial supplies, most of the labor and materials and service support can be satisfied locally.

Inasmuch as the primary objective of the development activity is to discover a local, natural energy resource to replace an existing generating system that uses imported oil, the social aspects of the proposed action from the community standpoint would not be the same as an action that introduced into the community a major new industry or process. Geothermal development is capitol intensive rather than labor intensive. Since a major portion of the labor and follow-on supplies for construction and continuing operations and maintenance related to geothermal development can be provided locally, there would be no need for an in-migration of people for geothermal development and operations activities.

It is believed that the nature of the proposed action that would occur in the geothermal resource sub-zone of the State lands to be exchanged, will not adversely affect life styles, goals or standards in the surrounding communities. Nevertheless, meetings will be held with individuals and associations in these communities to discuss details of the proposed development activities and to obtain community views on this project.

The assured availability of locally produced energy and the increased economic activity in the

County as well as the State which would result if geothermal development is successful would be expected to have generally positive long term social implications for the entire community.

4. Environmental Characteristics

The proposed action requires: access roads into the project site; drilling sites of 2-3 acres each; a rotary drilling rig (145 - 155 ft. in height); production and injection wells; power plant sites of 5 - 8 acres each; electrical generating power plants with capacities from 5MW (megawatts - 1MW = 1,000 Kilowatts) to 55MW with structure heights up to 65 ft.; geothermal fluid transmission pipelines, 14" to 20" in diameter to transmit geothermal fluid from the wells to the power plants; electricical transmission lines; and service/maintenance roads within the project site between wells and power plants.

The surface area required to develop underlying geothermal resources is estimated to be approximately 3 - 5% of the total acreage in the proposed geothermal resource sub-zone. In Hawaii, geothermal development will occur predominantly in the rift zones of active and dormant volcanoes and therefore be subject to the hazards of volcanic activity such as lava flows,

faulting and ground cracking and earthquakes.

As to operations, deep wells are drilled on a continuous basis, wells are vented (if required) and flow tested after completion, construction activity is ongoing, geothermal fluid is produced continually, and power plants are in continuous operation except when down for maintenance.

The principal aspects of the proposed action that have an effect on the environment are: clearing of sites for wells and facilities and for roads; noise from drilling, well-venting, construction activities, and operations; emissions from some of the chemical elements in the geothermal fluid during drilling, testing and normal operations. These aspects and others are discussed in the EIS and the Supplemental EIS.

(NOTE 5) - SECTION 1, PAGE 3

1. Description of Parcel

A. Existing Structures/Use: No structures; No current use of land.

B. Existing Utilities: None.

C. Existing Access: Access to the boundary of the State land finally exchanged to be determined and provided for by the State as an easement over other State lands adjoining the lands exchanged.

D. Vegetation: To be described in the Supplemental EIS.

E. Topography: See attached segment of U.S.G.S. map of State lands being appraised for exchange.

F. Shoreline: Not applicable.

G. Existing Covenants, Easements or Restrictions: None.

H. Historic Sites Affected: None known at this time.

(NOTE 6) - SECTION II, PAGE 3: DESCRIPTION OF ACTIVITY PROPOSED, PURPOSE, AND OPERATIONS TO BE CONDUCTED (DEVELOPMENT CONCEPT).

Description of Activity Proposed.

The proposed action is to conduct, as a permitted use within the State land to be exchanged and the to-be-desginated geothermal resource sub-zone, "geothermal development activities" as defined in Act 296, SLH, 1983, and Act 151, SLH, 1984:

Purpose of the Proposed Action.

To discover and utilize Hawaii's potentially significant quantity of reserves of geothermal energy to replace the use of imported oil as the principal energy source for generating electricity throughout the State. If successful, Hawaii would no longer be vulnerable to the chaotic conditions that could result if the supplies of that imported energy source were greatly reduced or terminated, or if the prices were arbitrarily increased by significant amounts as happened in 1972-73.

Of the natural energy sources available in Hawaii, geothermal energy has the potential of providing the greatest amount of base load electrical power in this century and for several decades beyond, and of displacing, annually, an average of 11,000,000 barrels of imported oil. However, the rate of geothermal development in Hawaii has not progressed as it has

in other parts of the world where such a resource is available.

Operations to be Conducted (Concept of Development)

The rate of future geothermal development will depend upon a number of factors including governmental permitting and public acceptance, and especially, the practical rate at which geothermal generated electricity can be absorbed into the utility systems to replace oil-generated electricity. In this respect, geothermal developers must plan and base exploration and development drilling requirements on the prospect of an underwater electric transmission cable being installed to interconnect the islands. (A joint project by the Department of Energy and the State of Hawaii has the objective of demonstrating the technical feasibility of installing such a cable in Hawaii.) Hence, the development of significant geothermal resources in Hawaii and the commercialization of a deepwater transmission cable are interdependent.

Geothermal developers must first prove (by deep exploration drilling) the existence of sufficient geothermal resources on the Big Island to justify continuing efforts to commercialize the cable in the near term. Secondly, and in close coordination with the business or agency responsible for commercializatin of the cable, geothermal developers must develop production wells on a schedule to assure that electric generating capacity from the geothermal fields approximately

matches the transmission capacity of the underwater cable on the date it is activated. (Under current planning, conditions and estimates, it would take three geothermal developers, operating with one drilling rig each, until 1995 to have on line 500mw of electric generating capacity.)

The scope of the proposed action is to develop sufficient geothermal resources and to construct, or cause to be constructed, the facilities necessary to generate and sustain 100mw of electric power generation over a period of 30 or more years.

It is also proposed that a variance be authorized in the land use permit to exceed up to 20% of the approved production level upon request by the Operator and aprpoval by DLNR of a modification to the Plan of Operations in those cases where the exceedance would occur after installed generating systems have attained the permitted level of production and the exeedance is demonstrated to be the result of:

(1) Increased efficiencies in the technology and equipment for conversion of geothermal resources to electricity and/or

(2) Unexplained increases in the energy characteristics of the reservoir such as increased temperature, flow rate, partitioning ratio, etc.

However, if an unexpected market demand would exceed the production level approved by the CDU permit together with any

variance that has been authorized, a new CDUA would be submitted to increase to an appropriate level the power production authorized for the project.

Recognizing that the rate of geothermal development is initially contingent upon the amount of geothermal energy that can be transmitted to and utilized by the electric utility companies and is therefore uncertain, this "Concept of Development" describes the magnitude or upper limit of geothermal development activities that would occur in developing geothermal production and electric generating systems capable of producing and sustaining 100mw of electricity. The supplemental EIS in support of this application is based on this level (100mw) of production.

(1) The initial, or exploration phase involves:

(a) Exploratory drilling with a rotary rig (approximately 150 ft. in height) to depths of 4,000 feet to 8,000 feet below sea level to intersect a geothermal reservoir of hot water or steam, or a combination of water and steam. Drilling of a well is normally continuous until the targeted depth is reached. The well bore is cased with steel pipe and cemented from surface to the desired depths. Several exploration wells may be required to discover a reservoir and to determine its direction and some

indications of its dimensions.

(b) Flow testing of the wells that intersect a reservoir is required to analyze the quality and characteristics of the resource and reservoir (temperature, pressure, flow rate, chemical analysis, ratio of steam to water, etc.). This information provides the basis for a decision on whether the resource at that particular site can be economically produced to generate electricity. Flow testing of exploratory wells, under controlled conditions to abate noise and emissions, normally, will require up to 30 days. During testing, the well flow is allowed to percolate into the ground at the drilling site as is being done at the HGP-A site.

(2) The development phase involves:

(a) Activities leading to the commercial production of the discovered geothermal resources. If a discovered geothermal reservoir is determined to be economically producible for generation of electricity, and there is a market demand for some level of power generation, additional (development) wells will be drilled to combine with one or more successful exploration wells to produce that amount of power. Additional

exploration wells may have to be drilled to "prove" the existence of other reservoirs within the GRS during the development phase.

(b) Concurrently, a power plant and related facilities are designed to generate the required amount of power and to control emissions to meet required air quality standards. An application to construct the power plant is submitted to the BLNR and to the Health Department. Supporting information must demonstrate that the emissions abatement and back-up systems will enable compliance with applicable Federal and State regulations on air quality standards under all anticipated meteorological conditions. The power plant is sited at the well head or drilling site or within approximately 2 miles of the wells that will supply the power plant.

In the production phase, wells are opened to flow into a separator where filtered steam is drawn into the turbine generator to produce electricity. Fluid not converted to steam in the separator and the fluid from the condenser (cooled in a cooling tower) are reinjected in a sealed well bore to approved, pre-determined depths.

(3) Scope of Proposed Action

The scope of project activity planned within the geothermal resource sub-zone of the State land to be exchanged is to develop, incrementally, the optimal geothermal energy potential of the prospective sub-zone subject to future power demands or market and the assessment of environmental impacts at each increment of development.

The first development increment for the proposed geothermal project represents the scope of action on which the SUP EIS will be based. Project activities that would occur during the first development increment include the following:

- preparing a primary and alternate access road into the GRS of the land to be exchanged.
- preparing separate drilling sites of 2 to 3 acres for each well. (In the development phase, directional drilling from the same site, when feasible, will reduce the number of drilling sites required.)
- constructing internal service roads to connect drilling and power plant sites.
- drilling and testing of up to 35 exploration and/or development wells.

- constructing electrical power plants at the drilling site or within 2 miles of the producible wells as the need for power is created. The first development increment on which the SUP EIS will be based would not exceed a production level of 100 MW of electricity; the capacity of power plants at any one site could vary from 5MW to 55MW and would require a surface area of 5 to 8 acres each. The first power plant is expected to have a capacity of 10-15 MW of power.
- connecting the producing wells to the power plants with steel pipelines, 12" to 20" in diameter.
- drilling up to 8 injection wells as may be required to reinject geothermal fluid after its usable energy is extracted during production operations.
- constructing a power transmission line from power plant to the boundary of the GRS to interconnect with HELCO's transmission lines.

Since the presence of a geothermal resource and the extent of its reservoir can only be determined by deep exploration drilling, and since geothermal power

plants must be located generally within 2 miles of its producing geothermal wells, it is not possible to prelocate these sites. The ultimate location and size of each power plant, as governed by the location and quality of the resource, must be approved on a site specific basis by DLNR or the County Planning Department as appropriate.

Similarly, because of the uncertainty of the quality of the resource and the production capability of each well, the approximate lowest individual well production level considered economically producible is used to estimate the maximum number of wells needed to generate the proposed production level for each development increment.

The SUP EIS will estimate the impacts of the types and general locations of facilities, access roads and tentative service roads, and the approximate surface area required for the level of development activities proposed and describe the measures necessary to reduce, avoid, monitor and control those impacts. On approval, the CDUA would establish the upper level of activities permitted in this increment of development.

Prior to any development activity being initiated within the GRS of the State lands to be

exchanged, a "Plan of Operations" is required to be submitted for approval to the Chairman of the Board of Land and Natural Resources in accordance with Chapter 183, (Rules on Leasing and Drilling of Geothermal Resources), Administrative Regulations, DLNR. Any changes to the Plan of Operations require approval of the Chairman, BLNR. In addition, each well to be drilled requires a separate permit from the Chairman, BLNR, and the County if drilling is on agricultural land.

The precise (surveyed) location of the initial drilling site as well as all subsequent drilling sites in this development increment, the exact location, capacity and design of electrical generating plants and the alignment of service or connecting roads between power plants and drilling sites will be included in individual permit applications to the Department of Land and Natural Resources, the Department of Health, EPA, and the County Planning Department as appropriate under existing law and regulations.

The combined effect of these individual permit applications (to be submitted as required during the period of development in the first development increment) will be consistent with the scope of develop-

ment activities proposed and approved for this increment including the estimates of dimensions of all facilities, surface requirements, and environmental impacts. All activities for which individual permits are required and the information or procedures in support of those applications will be in compliance with the Federal, State and County laws and regulations which govern activities associated with geothermal development.

OPERATING PERMITS REQUIRED FOR
GEOTHERMAL DEVELOPMENT ACTIVITIES

Except for the land use or Conservation District Use Permit, all other permitting requirements related to geothermal development operations within the jurisdiction of the Board or the Department of Land & Natural Resources are defined in DLNR Administrative Rules, Sub-Title 7, Watger and Land Development Chapter 183, Rules on Leasing and Drilling of Geothermal Resources:

(1) The geothermal mining lease, upon issuance by the Board, will "convey to the lessee, the exclusive rights to drill, discover, develop, operate, utilize and sell geothermal resources," granting a primary ten-year period with continuation periods subject to the conditions defined and will describe all other terms and conditions under which the geothermal development activities will be conducted.

(2) The Plan of Operations must be submitted to the Chairman for Board approval prior to commencing operations of any kind. The Plan of Operations requires specific and detailed data on the level of activity for which the plan is prepared, with the provision that after completion of the operations so authorized, any new or expanded oprations will require a new or amended plan of operations to be submitted in writing to the Chairman for approval in writing. In addition, the Plan of Operations must include provisions for monitoring to insure compliance with the

rules for operations. (The Plan of Operations, on approval, is assumed to be the basic operating permit that will govern and control the incremental development stages within the geothermal resource subm-zone up to the level approved in the land-use permit or CDUA.)

(3) Prior to conducting any drilling operations, an application for permit to drill must be submitted to the Chairman for approval accompanied by plot plans, drawings, and other data required by this rule, with the provision that changes to the original permit require written approval.

(4) Various after action and summary reports on project activity are required to be submitted to the Department of Land and Natural Resources in accordance with the Rules.

(5) Under the rules, the operator for the project is responsible to monitor localized environmental impacts associated with specific activities conducted or caused by the operator. (It is planned that an environmental monitoring plan will be included in the Plan of Operations when it is submitted for approval.)

(6) After completing the analysis of a discovered resource that is determined to be economically producible to generate electricity, and upon identification of a market to utilize that power, an application for "authority to construct" or install an electrical generating facility will be submitted to DLNR and the Health Department. Design plans including emission abatement

systems and air dispersion models will be included as supporting data to demonstrate that power plant emission controls will meet State standards.